Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

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0140012561

COMBINED SCIENCE **0653/32**

Paper 3 Theory (Core) **May/June 2020**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].
- The Periodic Table is printed in the question paper.

This document has **20** pages. Blank pages are indicated.

DC (DH/CB) 193256/5

[Turn over

1 **(a)** Fig. 1.1 shows red blood cells.

Fig. 1.1

(i) State the function of red blood cells.

.....

..... [1]

(ii) A component of the blood is needed to clot the blood.

State the name of this component.

..... [1]

(b) Fig. 1.2 shows a diagram of a different type of human blood cell.

The diameter **XY** in the diagram of the cell is 30 mm.

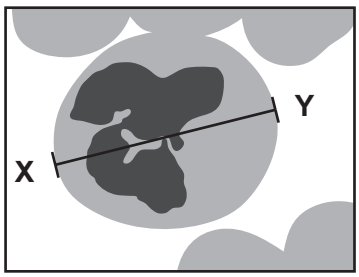

Fig. 1.2

The actual diameter **XY** of the cell is 0.015 mm.

Calculate the magnification of the cell shown in Fig. 1.2.

magnification = ... [2]

(c) Water is transported to the cells of the body by the blood.

Complete the sentence about movement of water into and out of cells.

Water diffuses through a ..... permeable membrane by ..... . [2]

(d) Water is also transported through plants.

(i) Fig. 1.3 shows the pathway taken by water through the cells of a root.

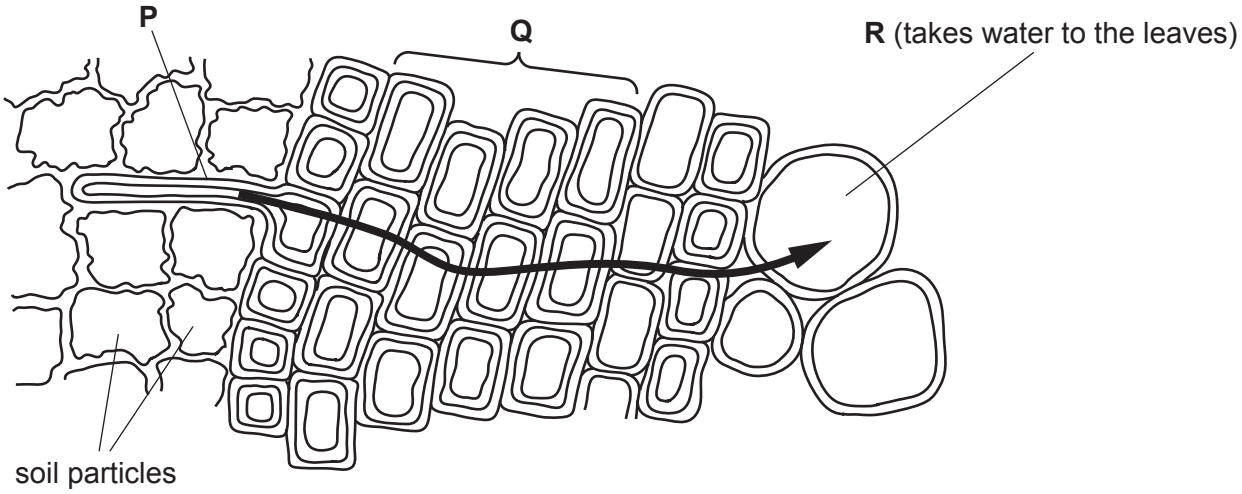

Fig. 1.3

Identify structures **P**, **Q** and **R** shown in Fig. 1.3.

P .....

Q .....

R .....

[3]

(ii) Transport of water in plants involves transpiration.

State **two** factors that **increase** the rate of transpiration.

1. .....

2. .....

[2]

[Total: 11]

2 **(a)** A teacher puts a small piece of sodium onto water in a water trough, as shown in Fig. 2.1.

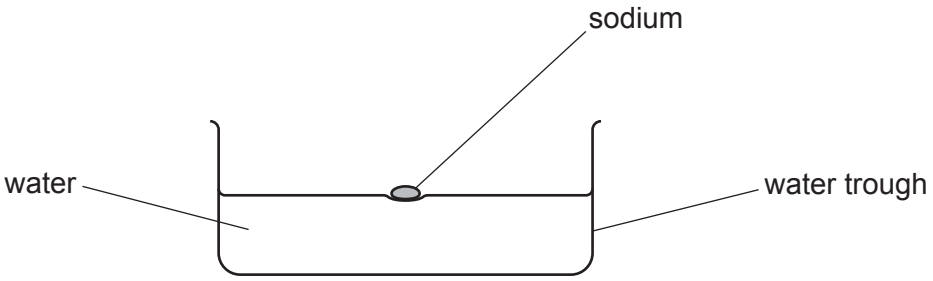

Fig. 2.1

The students observe the reaction between sodium and water.

The teacher repeats the experiment using potassium instead of sodium.

(i) Describe **one** similarity in the reactions of potassium and of sodium with water.

..... [1]

(ii) Describe **one** difference between the observations for the reactions of potassium and of sodium with water.

Explain the reason for this difference.

difference .....

explanation .....
[2]

(b) Iron is in a collection of metals in the Periodic Table shown on page 20.

(i) Name this collection of metals.

..... [1]

(ii) State **one** physical property of iron that is also a physical property of sodium.

..... [1]

(iii) State **one** property of iron that is **not** a property of sodium.

..... [1]

(c) The metals aluminium, copper and iron can be recycled.

State **one** reason, other than cost, why these metals can be recycled.

.....

.....

[1]

(d) An atom of aluminium is represented by the symbol shown.

$$^{27}_{13}Al$$

(i) Complete Fig. 2.2 to show the electronic structure of this atom.

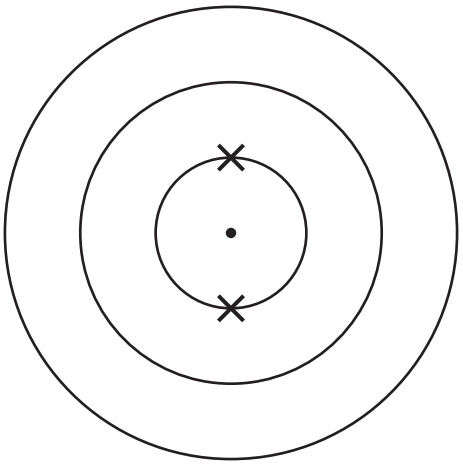

Fig. 2.2

[2]

(ii) Describe how this atom forms an aluminium ion, Al^{3+}.

.....

..... [1]

[Total: 10]

3 Fig. 3.1 shows a square sheet of metal.

The dimensions of the largest face are 20 cm × 20 cm.

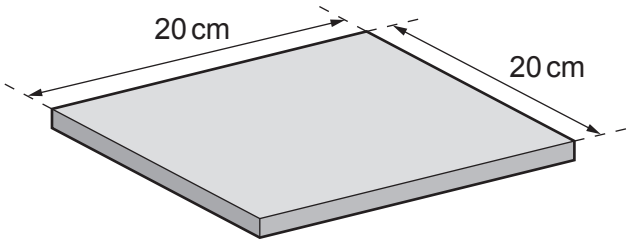

Fig. 3.1 (not to scale)

(a) (i) The thickness of the sheet is 1.1 cm.

Show that the volume of the sheet is 440 cm^3.

[1]

(ii) The mass of the sheet is 1800 g.

Calculate the density of the metal.

density = ... g/cm^3 [2]

(iii) The sheet lying flat on the ground in Fig. 3.1 exerts pressure on the ground.

Fig. 3.2 shows the sheet standing on one edge on the ground.

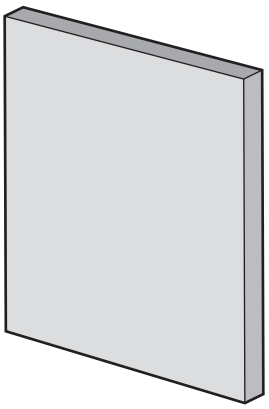

Fig. 3.2 (not to scale)

Explain why the sheet in Fig. 3.2 exerts a much greater pressure on the ground than the sheet in Fig. 3.1.

.....

.....

..... [2]

(b) The weight of the metal plate is 18 N.

The metal plate is lifted from the ground with an upwards force of 20 N.

(i) Calculate the resultant force on the metal plate.

resultant force = ... N [1]

(ii) Fig. 3.3 shows a speed–time graph for the plate as it is lifted from the ground until it stops moving again.

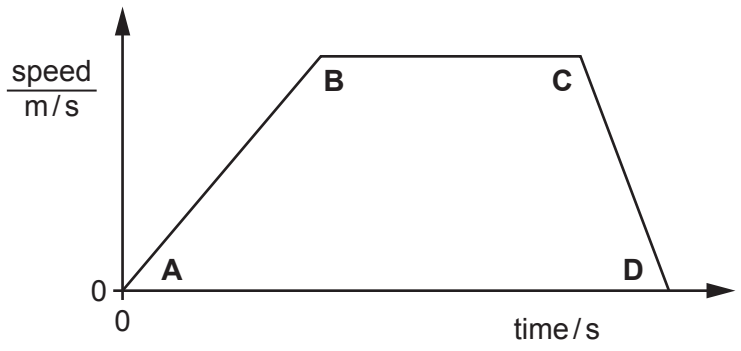

Fig. 3.3

Describe the motion of the plate between the points shown on Fig. 3.3.

A and **B** .....

B and **C** .....

C and **D** .....

[2]

[Total: 8]

4 **(a)** Fig. 4.1 shows the human alimentary canal and associated organs.

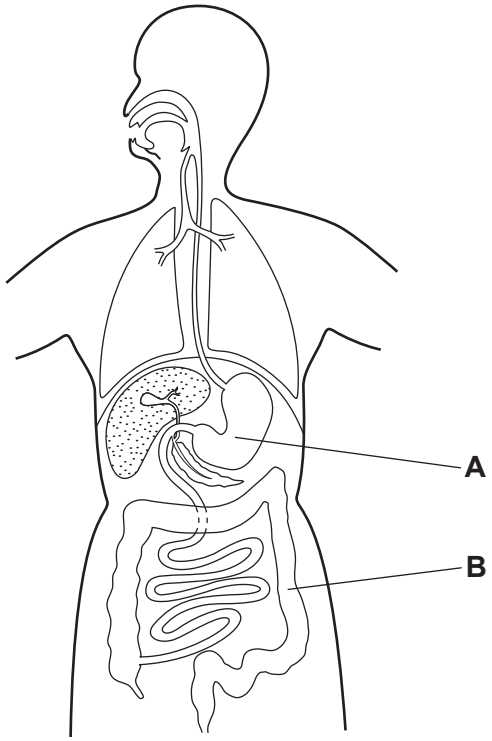

Fig. 4.1

(i) Identify parts **A** and **B** shown in Fig. 4.1.

A .....

B .....
[2]

(ii) Use a label line and the letter **X** to show a possible position of a salivary gland in Fig. 4.1.
[1]

(b) Large food molecules are made from smaller molecules.

Table 4.1 shows some large molecules and the smaller molecules they are made from.

Complete Table 4.1.

Table 4.1

large molecules	smaller molecules
glycogen	.....
.....	amino acids
oils	..... and .....

[3]

(c) Fig. 4.2 shows a graph of the activity of two enzymes **A** and **B** from the alimentary canal.

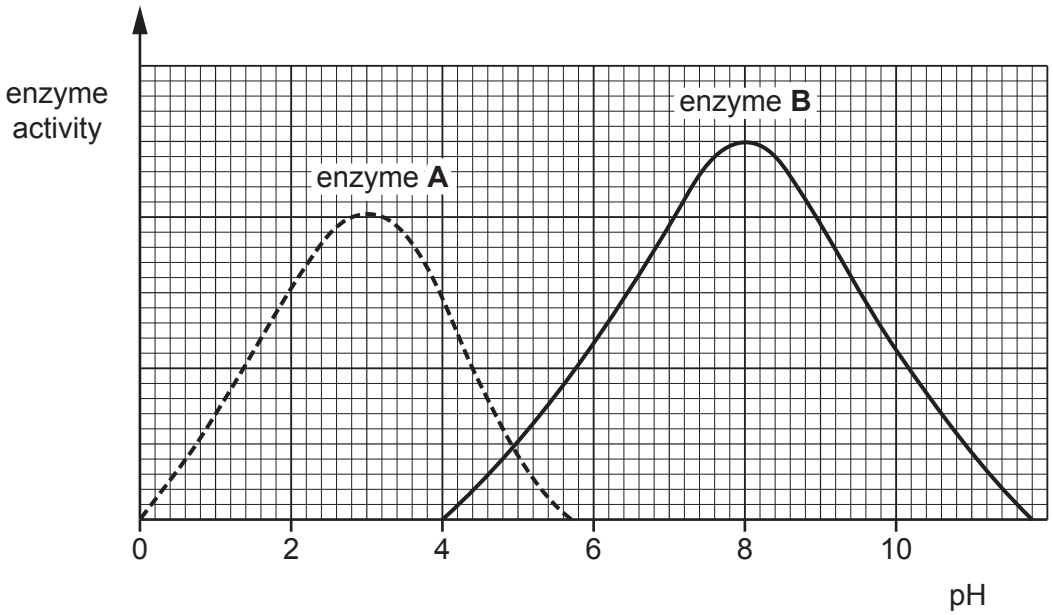

Fig. 4.2

(i) Describe the effect of changes in pH on the activity of enzyme **B**.

Use data from Fig. 4.2 to support your answer.

.....

.....

..... [2]

(ii) The stomach produces hydrochloric acid to kill bacteria in food.

Identify which enzyme **A** or **B** works best in the stomach.

Explain your answer.

enzyme .....

explanation .....

..... [1]

[Total: 9]

5 **(a)** A liquid fuel contains atoms of carbon and hydrogen only.

(i) State the type of compound which contains atoms of carbon and hydrogen only.

..... [1]

(ii) Deduce the naturally occurring substance from which this liquid fuel is obtained.

..... [1]

(iii) Deduce the type of chemical bond that forms between atoms of carbon and atoms of hydrogen.

..... [1]

(b) Propene is a gas at room temperature and pressure.

Fig. 5.1 shows the structure of a molecule of propene.

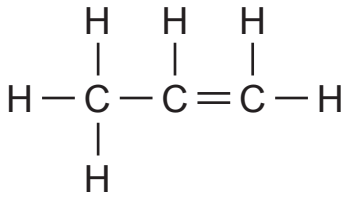

Fig. 5.1

(i) Deduce the formula of propene.

..... [1]

(ii) Describe the effect, if any, of propene on aqueous bromine.

.....

..... [1]

(iii) Complete the word equation for the complete combustion of propene.

propene	+		→		+	

[2]

(iv) Propene is transported as a liquid.

Describe the difference between gaseous propene and liquid propene in terms of the separation of the molecules and the motion of the molecules.

separation .....

.....

motion .....

.....

[2]

[Total: 9]

6 Fig. 6.1 shows a man holding a glass rod in one hand and a metal rod in the other hand. He holds both rods so that their ends are in a hot flame.

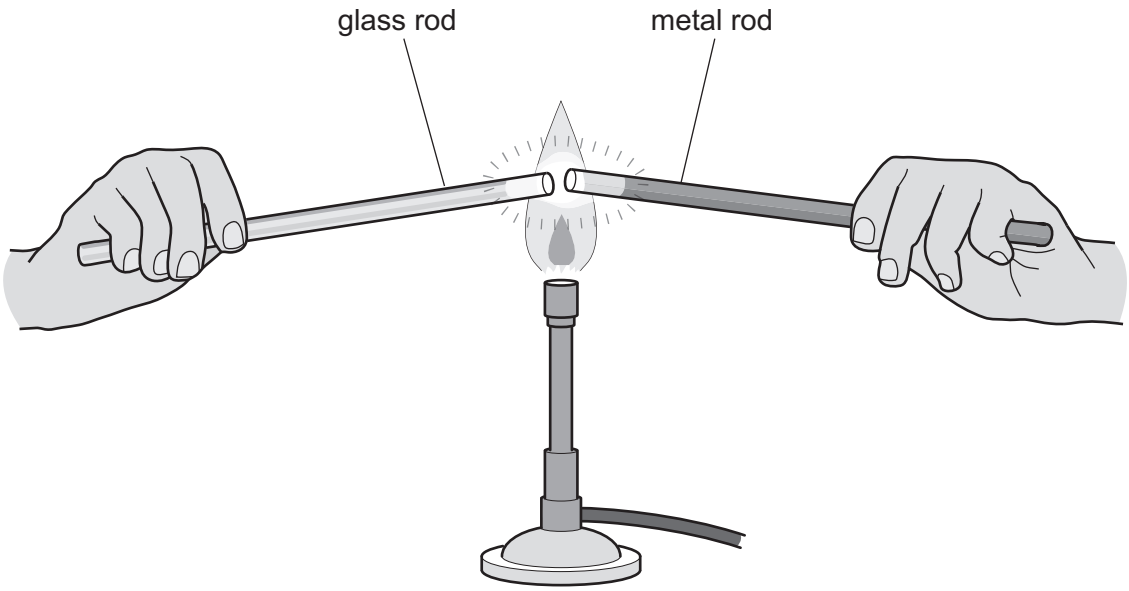

Fig. 6.1

(a) After some time, the man suddenly drops the metal rod because it becomes too hot.

He can hold the glass rod for a much longer time.

(i) State the method of thermal energy transfer along the metal rod to the man's hand.

..... [1]

(ii) State the method of energy transfer which does not require a medium to travel through.

..... [1]

(iii) Explain why the man can hold the glass rod for much longer than he can hold the metal rod.

.....

..... [1]

[Turn over

(b) The man now uses tongs to hold the two rods.

The temperature of the hot flame is gradually increased to a maximum of 900 °C.

At 500 °C, the end of the glass rod softens and melts, but the end of the metal rod does not melt.

The end of the metal rod melts before the maximum flame temperature is reached.

Table 6.1 shows the melting points of some metals.

Table 6.1

metal	melting point / °C
aluminium	660
copper	1083
iron	1535
silver	962
zinc	420

Identify the metal from which the metal rod is made.

..... [1]

(c) A metal bar is made of a strip of copper and a strip of iron fixed together. Fig. 6.2 shows the metal bar at room temperature.

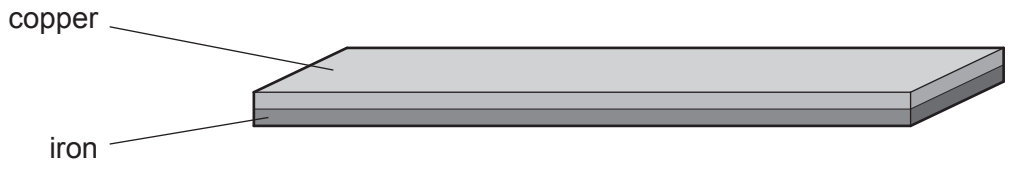

Fig. 6.2

Fig. 6.3 shows what happens to the bar when it is heated in the flame.

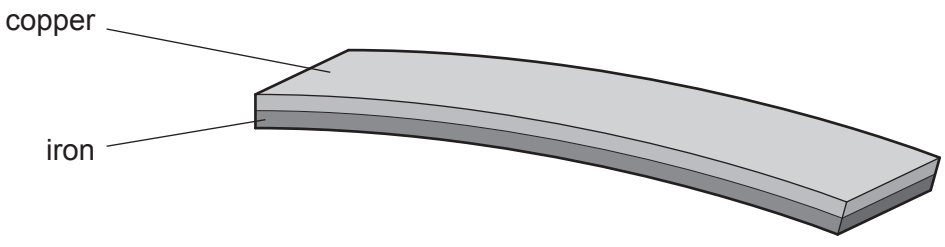

Fig. 6.3

Suggest why the bar bends when it is heated.

.....

.....

..... [2]

(d) (i) Fig. 6.4 shows a musical instrument called tubular bells. The instrument is made of different lengths of metal tubing.

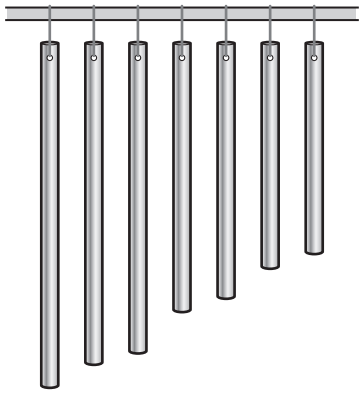

Fig. 6.4

The instrument is played by hitting the tubes with a plastic hammer.

Shorter metal tubes produce musical notes at a higher pitch than longer tubes.

Complete the sentences using words from the list.

Each word may be used once, more than once or not at all.

larger	**higher**	**longer**
lower	**shorter**	**smaller**

The frequency of the sound wave emitted by a longer tube is ..... than the frequency of the sound wave emitted by a shorter tube.

When the same longer tube is hit harder with the plastic hammer, the sound wave it emits has the same frequency but a ..... amplitude. [2]

(ii) On days when the temperature is very hot, the note emitted by each tube can change.

Suggest how the note from a tube might change when the temperature rises.

Give a reason for your answer.

.....

..... [1]

[Total: 9]

7 **(a)** Fig. 7.1 shows the male reproductive organs.

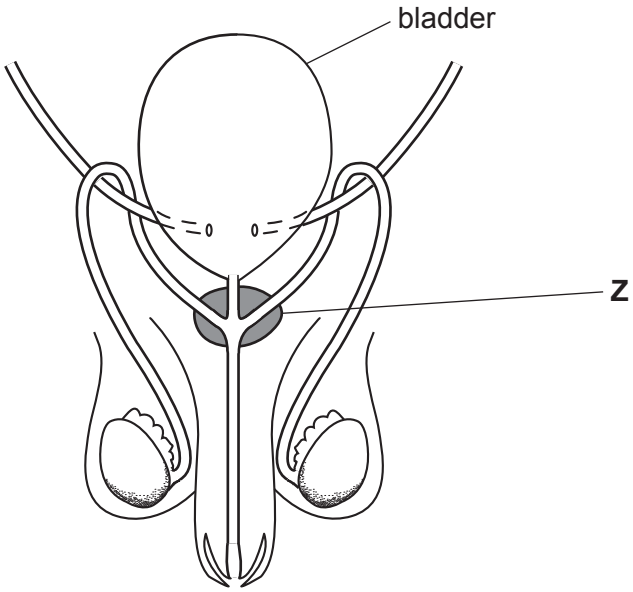

Fig. 7.1

Identify the name and function of part **Z** shown in Fig. 7.1.

name .....

function .....

.....

[2]

(b) Humans reproduce by sexual reproduction.

Some organisms reproduce by asexual reproduction.

State **two** ways in which sexual reproduction is different from asexual reproduction.

1. .....

.....

2. .....

.....

[2]

(c) Chlamydia, gonorrhea and HIV are sexually transmitted infections (STIs).

Fig. 7.2 shows the percentage of new cases of chlamydia, gonorrhea and HIV for one country in one year.

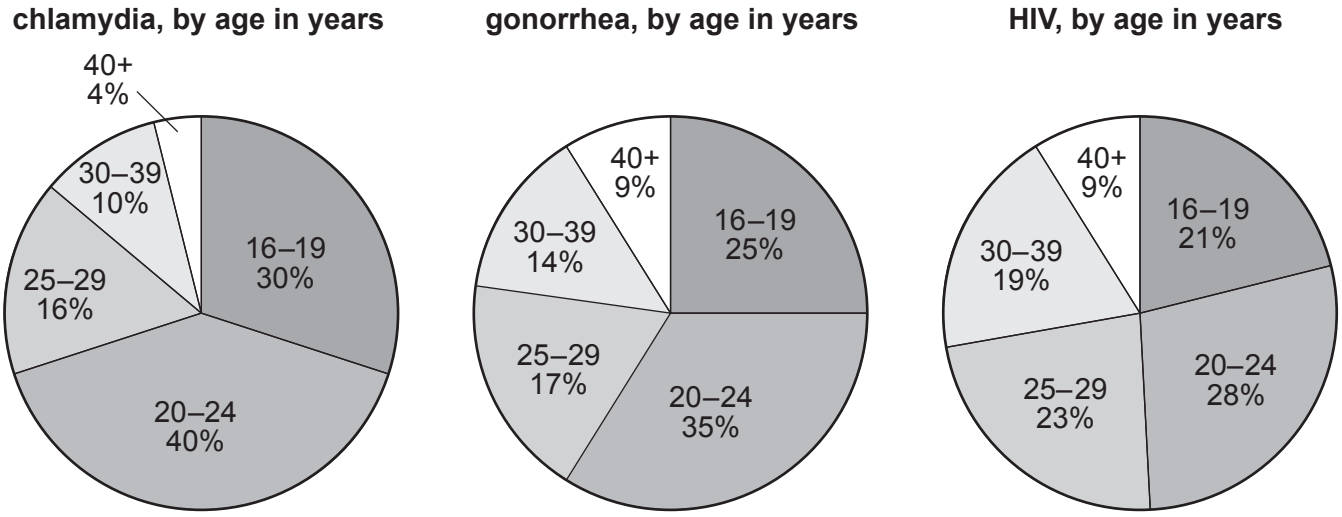

Fig. 7.2

(i) State the age group with the lowest percentage of HIV cases.

age group = ... years [1]

(ii) The country made this statement about the data.

Young adults aged 20–24 years are at ***greatest*** risk of sexually transmitted infections.

Identify evidence from Fig. 7.2 that supports this statement.

.....

..... [1]

(iii) Describe **one** way in which the spread of sexually transmitted infections is controlled.

.....

..... [1]

[Total: 7]

8 **(a)** Copper chloride is made in the reaction between excess solid copper carbonate and dilute hydrochloric acid.

The word equation for this reaction is shown.

copper carbonate	+	hydrochloric acid	→	copper chloride	+	carbon dioxide	+	water

(i) Describe how unreacted copper carbonate is removed from the mixture when the reaction is complete.

..... [1]

(ii) Suggest how solid copper chloride is obtained from the aqueous copper chloride that forms.

..... [1]

(iii) State the test for carbon dioxide and the positive test result.

test .....

result .....
[2]

(b) Chlorine is produced when electricity is passed through concentrated aqueous sodium chloride, as shown in Fig. 8.1.

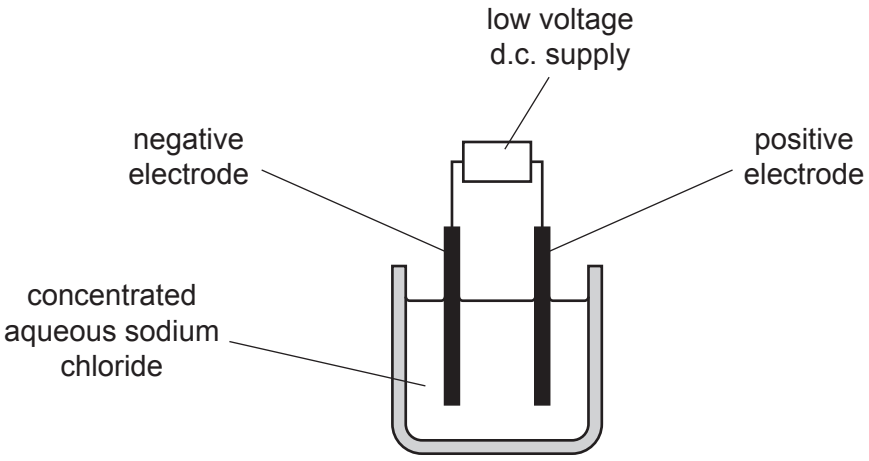

Fig. 8.1

(i) Name this process.

..... [1]

(ii) Identify the solvent and the solute through which electricity is passed during this process.

solvent.....

solute ..... [1]

(iii) Identify **one** element in the same group of the Periodic Table as chlorine that has a higher melting point than chlorine.

..... [1]

[Total: 7]

9 Fig. 9.1 shows a simple circuit containing two identical lamps **A** and **B**.

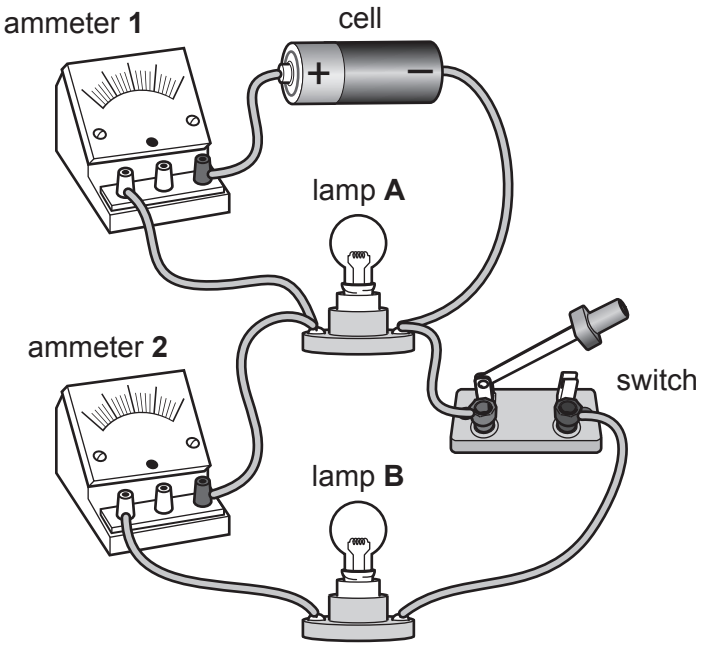

Fig. 9.1

(a) (i) The switch in Fig. 9.1 is open. Circle the correct configuration of the lamps.

lamp **A**: ON / OFF lamp **B**: ON / OFF

[1]

(ii) The switch shown in Fig. 9.1 is now closed. Circle the correct configuration of the lamps.

lamp **A**: ON / OFF lamp **B**: ON / OFF

[1]

(b) (i) Name the type of circuit arrangement of the two lamps in this circuit.

..... [1]

(ii) Draw the circuit diagram for the circuit pictured in Fig. 9.1.

[3]

(c) When both lamps are lit, ammeter **1** shows the total current in the circuit. The reading on ammeter **1** is 0.60 A.

(i) Suggest the reading on ammeter **2**.

Explain your answer.

reading = ...

explanation .....

.....

[2]

(ii) The combined resistance of lamps **A** and **B** when both are lit is 2.5 Ω.

Calculate the potential difference (p.d.) across the cell.

potential difference = ... V [2]

[Total: 10]

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).